# ARTIFICIAL NEURAL NETWORKS FOR AIR QUALITY MANAGEMENT

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## Abstract:

The improvement of air quality and protection of human health implies defining efficient air quality strategies. Regional authorities and decision-makers need suitable tools to evaluate both the impact of emission reduction strategies on pollution indexes and the costs of such emission reductions. In order to quickly compute the impact of different emission scenarios on air quality, non-linear models based on Artificial Neural Networks (ANN) can be applied. This paper describes and assesses the capability of non-linear models to capture the relationships between emissions and air concentrations using as case study the Northern Region of Portugal. Aiming to identify the ANN, a set of 10 simulations was performed using a Chemical Transport Model (CTM) fed with different emission reduction scenarios for $NO_2$ and PM10, and a technique for aggregating the emissions in four triangular slices (to reflect the influence of the surrounding cell emissions and the influence of the prevalent wind directions on the study domain) was used. The results show that the selected source–receptor models are able to accurately reproduce the simulated results by the CTM, with much lesser computational costs. Furthermore, the RIAT+ tool (Regional Integrated Assessment Tool +) was used to cost-efficiently define air quality improvement policies. The RIAT+ optimal solutions indicate that external costs (or benefits) are always higher than the internal costs (implementation costs). This fact points out that acting on emission control to reduce both PM10 and $NO_2$ concentrations is greatly beneficial from a socio-economic point of view. The tested ANN have proven to be a viable substitute for highly time demanding deterministic models, and can be used in scenario analysis and optimization techniques.

**Keywords:** Air Quality Policies, Artificial Neural Networks, Integrated Assessment Tool

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